REMARKS

This amendment is responsive to the Office Action that was mailed January 30, 2004 (hereinafter "Office Action") and the Notice of Non-Compliant Amendment that was mailed on June 15, 2004. The form of this Amendment is the Revised Amendment Format under 37 C.F.R. § 1.121 that became effective July 30, 2003.

Claim Amendments

Claim 1 has been amended to correct a spelling error. Claims 25 and 27 (referred to in the Office Action as claims 13 and 15, respectively) have been amended to correct grammatical errors. These amendments do not introduce new matter nor do they result in a narrowing of the scope of the claimed subject matter.

Rejection of claims under 35 U.S.C. § 103(a)

Claims 1-3, 25 and 27 (the latter two claims referred to in the Office Action as claims 13 and 15, respectively) stand rejected under 35 U.S.C. § 103(a) as being unpatentable over the combined teachings of *Towler et al.* ("Towler") and *Frye, et al.* ("Frye").

Rejection of Claim 1

Towler discloses a process and system for generating hydrogen for use in fuel cells, wherein air feeds to a hybrid reforming reactor (26) and to a burner (22) are varied in order to control the reaction temperatures within those devices. The system is further described as having a pre-reforming unit (14) and a water gas shift reactor (18), each of which is thermally integrated with other elements of the system. Improvements in thermal efficiency and lower reforming reaction temperatures are purportedly achieved with the disclosed design.

It is the position of the Office that reactor 26 is a reactor stack that includes a plurality of cylindrical vessels (24 and 28) that are stackable without connecting piping between each vessel. Figure 1 of Towler is specifically referenced by the Office as illustrating a plurality of cylindrical vessels that are stackable without connecting piping. Applicant respectfully disagrees with this interpretation of Figure 1 and the asserted disclosure of Towler generally.

A review of Figure 1 finds a schematic block flow diagram that includes a schematic of a reactor vessel at reference number 26. The schematic of this vessel is shown as an elongated vessel having rounded end sections at opposite ends of an elongated mid-section. A conventional symbol that is commonly used to represent a packed section of a vessel is shown in two locations within the reactor mid-section. See *Chemical Process Technology*, Moulijn et al., (John Wiley and Sons Ltd, © 2001) p. 441, regarding the conventional nature of the symbol used in Figure 1. These symbols are shown spaced apart from one another at reference numbers 24 and 28, but are not otherwise identified or characterized in Figure 1. Elements 24 and 28 are described in the specification as catalyst-containing reaction zones, namely, partial oxidation reaction zone 24 and reforming reaction zone 28. Notably, no other structure or feature of the reactor vessel or of reaction zones 24 and 28 is illustrated in Figure 1.

The specification in Towler explicitly describes that the two reactions zones (24 and 28) are combined within a common hybrid reaction zone or vessel. See col. 17, lines 34-36, and col. 1, lines 6-10 referring to the disclosed reactor as a "hybrid reforming reactor." There is no teaching or suggestion in the specification that the reactor vessel or the reaction zones should be cylindrical nor is there any teaching or suggestion that the hybrid reforming reactor should comprise a plurality of cylindrical vessels that are stackable without connecting piping. In the absence of such disclosure in Towler or a showing that one of ordinary skilled in the art possessed such knowledge at the time the invention was made, the rejection of the claim 1 under Section 103 is without support.

> ...before we can conclude that any disclosed invention is "obvious" under the conditions specified in 35 U.S.C. 103, we must evaluate facts from which to determine 1) what was shown in the prior art at the time the invention was made, and 2) the knowledge which a person of ordinary skill in the art possessed at the time the invention was made. We are unwilling to substitute speculation and hindsight appraisal of the prior art for such factual data.

In re Clause, 133 U.S.P.Q. 360; 301 F. 2d 686, 690 (CCPA 1962).

Moreover, the specification in Towler teaches away from reactor designs wherein the partial oxidation and steam reforming reaction zones would be located in separate vessels. Specifically, the purported improvements in thermal efficiency and reduced reforming reaction temperatures that are achieved by the Towler design are described as being due in part to co-locating these reaction zones in close proximity to one another so that heat derived from the exothermic partial oxidation reaction is provided to the endothermic reforming reaction. See col. 10, lines 5-10. One skilled in the art would not have been motivated based on the disclosure of Towler to distance the partial oxidation zone from the steam reforming zone by disposing those reaction zones in separate or discrete cylindrical vessels.

In sum, Towler discloses a hybrid reforming reactor that houses a pair of reaction/catalyst zones that are aligned vertically within the reactor. There is no teaching or suggestion in disclosure of Towler that the reaction zones should be disposed within separate cylindrical vessels, or more particularly, that the disclosed hybrid reforming reactor should comprise a plurality of cylindrical vessels that are stackable without connecting piping between the vessels. Regarding claim 1, neither Towler nor Frye teaches or suggests a fuel processor comprising a reforming stack that includes a plurality of cylindrical vessels that are stackable without the need for connecting piping between the vessels.

It is respectfully requested that the rejection of claim 1 under 35 U.S.C. § 103(a) as being unpatentable over the combined teachings of Towler and Frye be withdrawn.

Rejections of Claims 2 and 3

Regarding claim 2, it is the position of the Office that Frye discloses a multi-bed hydrodesulfurization means of a stacked formation that includes cylindrical vessels 26, 28, 30, 32, 34, 36, and 38 that are stackable without piping connecting the vessels. Figure 1 of Frye is specifically referenced by the Office as illustrating a plurality of cylindrical vessels that are stackable without connecting piping. Applicant respectfully disagrees with this interpretation of Figure 1 and the asserted disclosure of Frye generally.

A review of Figure 1 finds a schematic illustration of a desulfurization system that includes reactor 24. In this schematic the reactor is shown as an elongated vessel having rounded end sections at opposite ends of an elongated mid-section. A conventional symbol that is used to represent a packed section of a vessel is shown in four locations within mid-section of the reactor. See *Chemical Process Technology*, Moulijn et al., (John Wiley and Sons Ltd, © 2001) p. 441, regarding the conventional nature of this symbol. These four symbols are shown spaced apart from one another and are indicated by reference numbers 26, 28, 30, and 32. The elements at reference numbers 26, 28, 30, and 32 are not identified or characterized in Figure 1 but are described in the specification as desulfurization catalyst beds, namely, first catalyst bed 26, second catalyst bed 28, third catalyst bed 30 and final catalyst bed 32. The portions of the reactor in the spaces between the catalyst beds are referred to in the specification as interbed transfer sections 34, 36, and 38. Col. 4, lines 57-61. Each of these interbed transfer sections is illustrated as having valve-controlled inlets and outlets. No other structure or feature of reactor 24, the catalyst beds or the interbed transfer sections is illustrated in Figure 1.

In the process disclosed in Frye, heavy fuel oil is heated and flowed down through multi-bed desulfurization reactor 24. Based on the temperature of the process stream or the pressure drop across a given catalyst bed, either a heated

or a quench fluid can be injected into the interbed transfer section and mixed with the process stream for adjusting the temperature of the process stream. Col. 4, line 62 bridging to col. 5, line 64. Purportedly, control of the process stream temperature enables better control of the desulfurization reaction occurring in each of the catalyst beds, and as a result, a more efficient utilization of the catalyst in those beds. Col. 4, lines 18-28.

In sum, Frye discloses a desulfurization reactor having multiple catalyst beds vertically aligned within the reactor and a process for operating that multi-bed reactor more efficiently. There is no teaching or suggestion in Frye that the catalyst beds or the interbed transfer sections should be housed within a plurality of individual or discrete vessels, or more particularly, that those vessels should be cylindrical in shape. Furthermore, there is no teaching or suggestion in the disclosure of Frye that the disclosed desulfurization reactor should comprise a plurality of cylindrical vessels that are stackable without connecting piping between the vessels. In the absence of such disclosure in the cited references or a showing that one of ordinary skilled in the art possessed such knowledge at the time the invention was made, the rejection of the claim 2 under Section 103 is without support.

It is respectfully requested that the rejection of claim 2 under 35 U.S.C. § 103(a) as being unpatentable over the combined teachings of Towler and Frye be withdrawn. Claim 3 is believed to be in condition for allowance by virtue of its dependency from claim 2.

Rejection of Claims 25 and 27

Claim 25 (referred to in the Office Action as claim 13) recites a compact fuel processor comprising among other limitations a reforming stack comprising a plurality of cylindrical modular units each of which is stackable and separable.

It is the position of the Office that Towler discloses a reforming stack that includes a plurality of cylindrical units, each of which is stackable. The basis for

this position is the disclosure of Figure 1 of Towler. As noted above in the discussion concerning the rejection of claim 1, Figure 1 of Towler discloses a hybrid reforming reactor having partial oxidation and steam reforming reaction zones that are vertically aligned within the reactor. There is no teaching or suggestion in Towler that the reaction vessel should comprise a plurality of cylindrical modular units each of which is stackable.

Regarding the separable nature of the cylindrical units, the Office expressly recognizes that both Towler and Frye are silent as to this feature. However, the Action contains the statement that:

> "[I]t is held that making an integral structure of a known device separable is an obvious variant of the device and is not the type of innovation for which a patent monopoly is to be granted."

See page 4 of the Action mailed January 30, 2004. No evidence or reference is cited in support of this proposition. Furthermore, no discussion is provided concerning the disclosure of the prior art or the knowledge of one skilled in the art or how such disclosure or knowledge might compare with the claimed invention. As such, the application of this proposition appears to be a *per se* rule of obviousness that could equally be applied to reject claims to any device wherein a component or feature of the device is characterized as being separable or divisible from the whole. Applicant would respectfully point out that the Court of Appeals for the Federal Circuit has clearly rejected the use of *per se* rules of obviousness as failing to comport with 35 U.S.C. §103.

> ...reliance on *per se* rules of obviousness is legally incorrect and must cease. Any such administrative convenience is simply inconsistent with section 103, which according to *Graham* and its progeny, entitles applicant to issuance of an otherwise proper patent unless the PTO establishes that the invention *as claimed* in the application is obvious over cited prior art, based on the specific comparison of that prior art with claim limitations. We once again hold today that our precedents do not establish any *per se* rules of obviousness....

In re Ochiai, 37 U.S.P.Q.2d 1127; 71 F.3d 1565, 1572 (CAFC1995)(emphasis original). The issue of whether a fuel processor comprising a reforming stack

comprising a plurality of separable cylindrical modular units is obvious requires consideration of whether the teachings of the prior art would, in and of themselves and without the benefit of applicant's disclosure, make the invention as a whole obvious. In re Nomiya et al., 184 U.S.P.Q. 607; 509 F. 2d 566, 571-2 (CCPA 1975).

It is further the position of the Office that one skilled in the art would have been motivated to modify the hybrid reforming reactor of Towler to comprise separable units for the "obvious advantages" of ease of replacement and ease of cleaning. See page 4 of the Action mailed January 30, 2004. Applicant respectfully disagrees for the reasons that the prior art does not suggest the desirability of the claimed invention, because the proposed modification of Towler would render it unsatisfactory for its intended purpose (M.P.E.P. §2143.01), and further because one skilled in the art would have lacked a reasonable expectation of success in making the suggested modification to Towler (M.P.E.P. §2143.02).

Foremost, Applicant respectfully disagrees that the ease of replacement and cleaning are "obvious advantages" to be included in a fuel processing reactor design. Neither Towler nor Frye teaches or suggests that replacement or cleaning of the reactor vessels are problems that need to be addressed. As such, it is unclear why one skilled in the art would have chosen to modify the reforming reactor vessel of Towler, or more specifically, why one skilled in the art would have chosen to modify Towler in the manner suggested by the Office over any other method or means that could have been used to facilitate such replacement or cleaning. If it is the intent of the Office to rely on the fact that one skilled in the art would have possessed the knowledge that fuel reforming reactors can comprise cylindrical modular units that are separable for the purpose of replacing and cleaning such units, Applicant requests that that the Office provide documentary evidence in support of this conclusion in accordance with M.P.E.P. §2144.03.

Applicant also maintains that one skilled in the art would not have been motivated to modify the reactor vessel of Towler in the manner suggested by the Office for the reason that such modification would render the Towler reactor unsatisfactory for its intended purpose. M.P.E.P. §2143.01. More specifically, the modification of the hybrid reforming reactor disclosed in Towler by disposing the partial oxidation reaction zone apart from the steam reforming zone in separate discrete cylindrical vessels would defeat the intended purpose of the design, which is expressly described as providing for the efficient transfer of heat from the exothermic partial oxidation reaction to the endothermic reforming reaction. Col. 9, line 56 bridging to col. 10, line 34.

Moreover, the Office has not offered or identified any evidence that would tend to show why one skilled in the art would have had a reasonable expectation of success in combining the teachings of Towler and Frye and in modifying the hybrid reforming reactor of Towler to comprise a plurality of cylindrical modular units, each of which is stackable, separable, and performs a separate operational function. See M.P.E.P. §2143.02.

In sum, it has not been shown that the prior art teaches or suggests a compact fuel processor comprising a reforming stack having a plurality of cylindrical modular units, wherein each of the cylindrical modular units is either stackable or separable. Further, in the absence of a motivation to modify Towler in the manner suggested, and/or the absence of a reasonable expectation of success in making such a modification, the claimed invention would not have been obvious in light of Towler and Frye.

It is respectfully requested that the rejection of claim 25 under 35 U.S.C. §103 be withdrawn. Claim 27 (referred to in the Office Action as claim 15) is believed to in condition for allowance by virtue of its dependency from claim 25 and in view of the remarks above.

Allowable Subject Matter

Applicant extends his gratitude for the examiner's comments concerning Claims 4-12, 26, 28 (the latter two claims referred to in the Office Action as 14 and 16), and the allowable subject matter contained therein. No amendments have been made in reference to Claims 4-12, as they are believed to be allowable because of their direct or indirect dependency from Claim 1 as discussed above. Likewise, No amendments have been made in reference to Claims 26 or 28, as they are believed to be allowable because of their direct or indirect dependency from Claim 25 (referred to in the Office Action as Claim 13) as discussed above.

* * * * *

All of the stated grounds of objection and rejection are believed to have been properly traversed, accommodated, or rendered moot. Applicant therefore respectfully requests that the Examiner reconsider all presently outstanding objections and rejections and that they be withdrawn. Applicant believes that a full and complete response has been made to the outstanding Office Action and, as such, the present application is in condition for allowance. If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

Prompt and favorable consideration of this Amendment is respectfully requested.

Respectfully submitted,

Frank C. Turner
Attorney for Applicant
Reg. No. 39,863

July 8, 2004
Chevron Services Company
1111 Bagby, Suite 4040
Houston, Texas 77002
(713) 752 3084 (voice)
(713) 752 7969 (fax)

Baffins Lane, Chichester,
West Sussex PO19 1UD, England
National 01243 779777
International (+44) 1243 779777

e-mail (for orders and customer service enquiries): cs-books@wiley.co.uk

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John Wiley & Sons (Canada) Ltd, 22 Worcester Road,
Rexdale, Ontario M9W 1L1, Canada

Library of Congress Cataloging-in-Publication Data

Moulijn, Jacob A.
Chemical process technology / J.A. Moulijn, Ir.M. Makkee, A.E. van Diepen.
p. cm.
Includes bibliographical references and index.
ISBN 0-471-63009-8 (alk. paper) -- ISBN 0-471-63062-4 (pb. : alk. paper)
1. Chemical processes. I. Makkee, Ir. M. (Ir. Michael) II. Diepen, A. E. van (Annelies E.) III. Title.

TP155.7 .M68 2001
660'.281--dc21

00-048590

British Library Cataloguing in Publication Data

A catalogue record for this book is available from the British Library

ISBN 0 471 63009 8 (HB)
0 471 63062 4 (PB)

Typeset in 10/12pt Times by Deerpark Publishing Services, Shannon, Ireland
Printed and bound in Great Britain by Antony Rowe Ltd, Chippenham, Wiltshire

This book is printed on acid-free paper responsibly manufactured from sustainable forestry, in which at least two trees are planted for each one used for paper production.

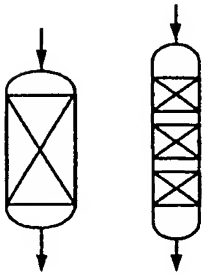
Appendix B

Main Symbols used in Flow Schemes

B.1 REACTORS AND OTHER VESSELS

Empty (reactor) vessel, vertical

Packing, e.g. catalyst, ion exchanger, structured/random packing



Vertical fixed-bed reactor with one bed and multiple beds

Multi-tubular reactor